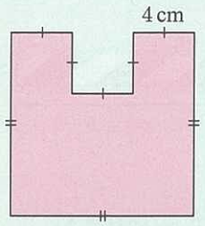
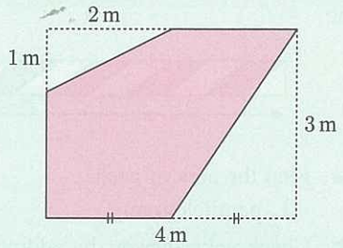
8 Find the pink shaded area:

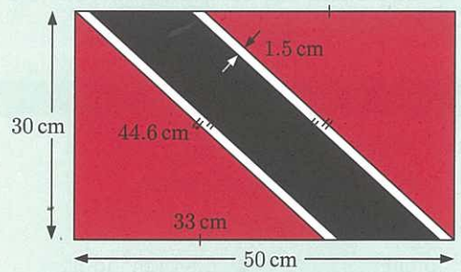
a



b



9



A flag of Trinidad & Tobago has the dimensions shown.
The white stripes have width 1.5 cm.

a Find the area of the flag.

b Find the area of:

i a red triangle

ii a white stripe.

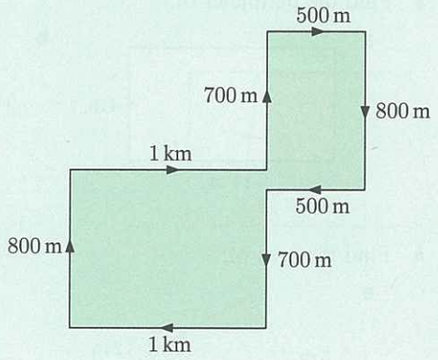
c Hence find the area of the black stripe.

10 A street circuit for a car race is shown alongside.

a Find the length of one lap around the circuit.

b How far will cars travel during a 50 lap race?

c Find the area of the region inside the race track.



Chapter 12

Coordinate geometry

Contents:

OPENING PROBLEM

Scientists and archeologists often use grids when searching for fossils and ancient artefacts. They do this so they can accurately record the location where each object is found.

Things to think about:

a Professor Johnson has used pegs and ropes to form a grid over his excavation site. What else does he need so he can record the positions of his discoveries?

b How can Professor Johnson improve his accuracy in identifying positions? Discuss your ideas with your class.

c Professor Johnson wants to record the position of the object in his grid *and* the depth at which it was found. Suggest a way in which he could do this.

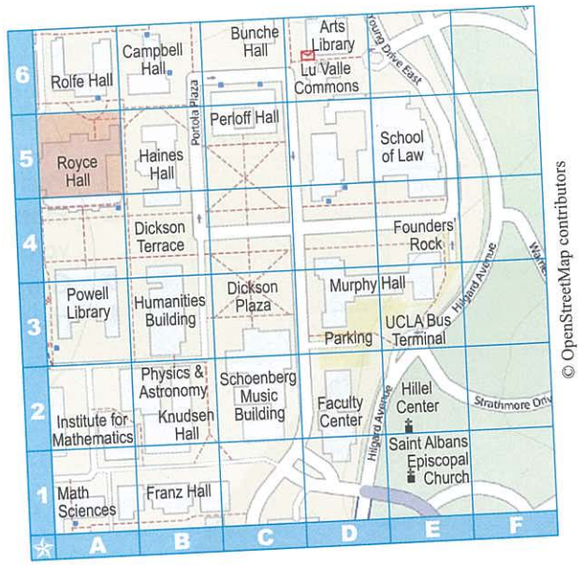
You have probably seen **map references** before in a street directory or an atlas.

Horizontal and vertical lines divide the map into regions. We can describe the location of a feature using a letter and number combination.

For example, the combination A5 refers to the region shaded.

We can see that Royce Hall is found in region A5. We say that A5 is the **map reference** for Royce Hall. It does not describe the *exact* location of Royce Hall, but it tells us where to look.

To describe a location more accurately, we can use **coordinates** on a **number grid**.



HISTORICAL NOTE

Frenchman **René Descartes** found a method for describing the position of a point in a plane. His work led to a new branch of mathematics called **coordinate geometry**.

One of Descartes' principles was "never to accept anything as true which I do not clearly and distinctly see to be so". This is a good piece of advice for your own study of mathematics.

A NUMBER GRIDS

A **number grid** can be used to locate the exact position of any point on a plane.

The number grid contains horizontal and vertical **axes** of reference. We label both axes with numbers, and the numbers are placed on grid lines, not in the regions between them.

The horizontal axis is called the **x-axis**.

The vertical axis is called the **y-axis**.

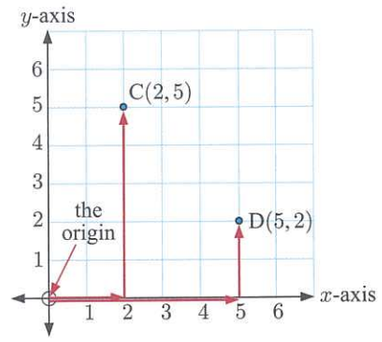
The point of intersection is called the **origin, O**.

To get from the origin to point C, we first move 2 units in the x-direction and then 5 units in the y-direction. We say that C has **coordinates** $(2, 5)$. The **x-coordinate** is 2 and the **y-coordinate** is 5.

To get from the origin to point D, we first move 5 units in the x-direction and then 2 units in the y-direction. We say that D has coordinates $(5, 2)$.

These coordinates are called **ordered pairs** because we move first in the x-direction and then in the y-direction.

Notice that $C(2, 5)$ and $D(5, 2)$ are at different positions in the number plane.

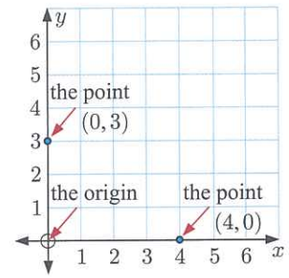


POINTS ON THE AXES

Consider a point with x-coordinate 0. It lies on the y-axis, because there is no movement to the right, only up.

Now consider a point with y-coordinate 0. It lies on the x-axis, because there is no movement up, only to the right.

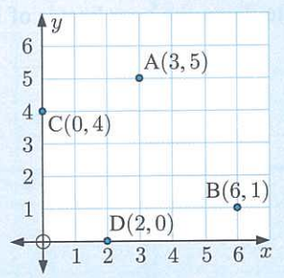
The **origin O** has coordinates $(0, 0)$. It is marked with a small circle at the intersection of the axes.



Example 1 — Self Tutor

On the same set of axes, plot and label the points with coordinates:

$A(3, 5)$, $B(6, 1)$, $C(0, 4)$, $D(2, 0)$.



EXERCISE 12A

1 On graph paper, draw a set of axes. Plot and label the following points:

a A(2, 2)	**b** B(4, 8)	**c** C(3, 1)
d D(7, 0)	**e** E(0, 5)	**f** F(5, 4)
g G(9, 1)	**h** H(6, 0)	**i** I(0, 1)
j J(7, 7)	**k** K(0, 0)	**l** L(8, 3)

2 Copy and complete:

a The .....-coordinate of a point on the x-axis is 0.

b The .....-coordinate of a point on the y-axis is 0.

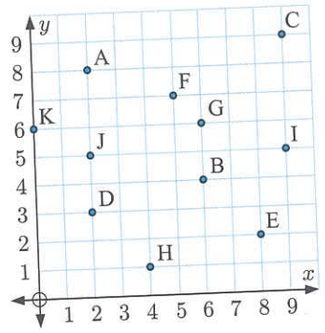
3 Write down:

a the x-coordinate of:
i B **ii** A **iii** C **iv** G

b the y-coordinate of:
i E **ii** H **iii** J **iv** K

c the coordinates of each point

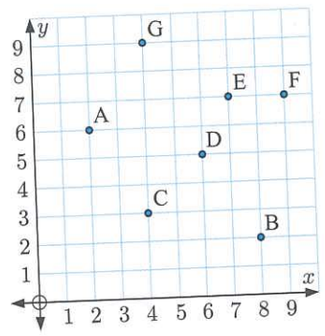
d the coordinates of the origin, O.



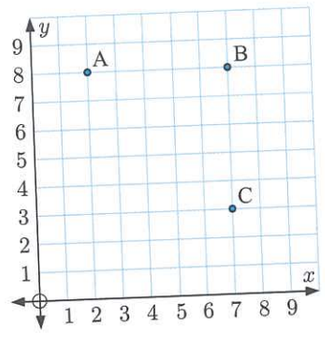
4 **a** Name two points with the same x-coordinate. What do you notice about these points?

b Name two points with the same y-coordinate. What do you notice about these points?

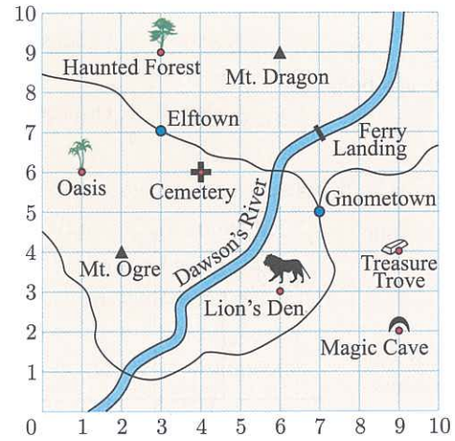
c Name the point whose x-coordinate is equal to its y-coordinate.



5 ABCD is a square. A, B, and C are marked on the grid. Write down the coordinates of D.



6



Use the map to find:

a the grid coordinates for:
i Gnometown
ii Magic Cave
iii Ferry Landing
iv where the roads cross Dawson's River

b the places located at:
i (9, 4) **ii** (6, 3)
iii (2, 4) **iv** (1, 6)

7 **a** On a set of axes, plot and label the points A(3, 1), B(6, 2), C(9, 3), and D(12, 4).

b Join these points. What do you notice?

c If the pattern continues, what will the next point be?

8 **a** On a set of axes, plot and label the points A(0, 10), B(1, 8), C(2, 6), and D(3, 4).

b If the pattern continues, what will the coordinates of the next two points be?

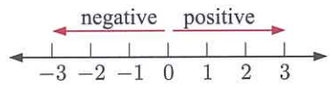
ACTIVITY **HOPPING AROUND A NUMBER PLANE**

For this Activity, click on the icon to obtain instructions and a printable grid.

ACTIVITY

B POSITIVE AND NEGATIVE COORDINATES

In **Chapter 3** we saw how the number line was extended in two directions to include positive and negative numbers.



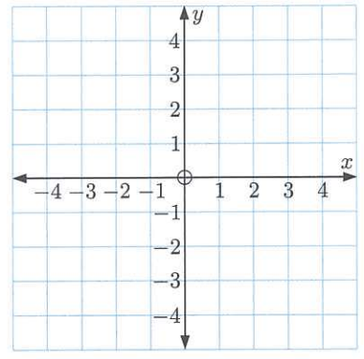
To extend the number plane studied in the last Section, we extend both the x-axis and the y-axis in two directions. This allows us to consider positive *and* negative coordinates.

In the centre of the number plane is the origin O.

The x-axis is positive to the right of O, and negative to the left of O.

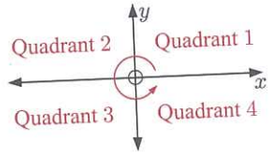
The y-axis is positive above O, and negative below O.

This number plane is called the **Cartesian plane**.



The axes divide the plane into four **quadrants**.

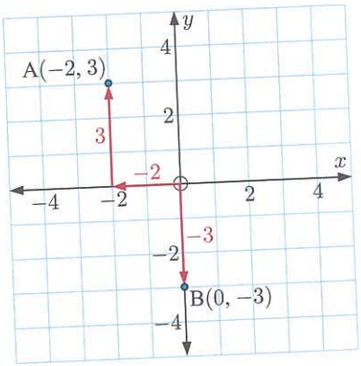
The quadrants are numbered in an anticlockwise direction, starting with the upper right hand quadrant in which x and y are both positive.



We can now describe and plot points in any of the four quadrants or on either axis.

For example:

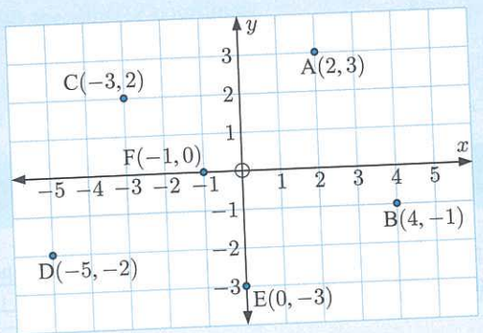
- To plot the point A$(-2, 3)$, we move 2 units to the *left* of the origin, then 3 units up. A is in the second quadrant.
- To plot the point B$(0, -3)$, we do not move left or right, but we move 3 units down. B is on the y-axis.



Example 2 Self Tutor

Plot the following points on the Cartesian plane:

A$(2, 3)$, B$(4, -1)$, C$(-3, 2)$, D$(-5, -2)$, E$(0, -3)$, F$(-1, 0)$.



EXERCISE 12B

1 Draw a set of axes, then plot and label the following points:

a A$(3, 4)$ **b** B$(6, 2)$ **c** C$(-3, 0)$ **d** D$(-5, -5)$

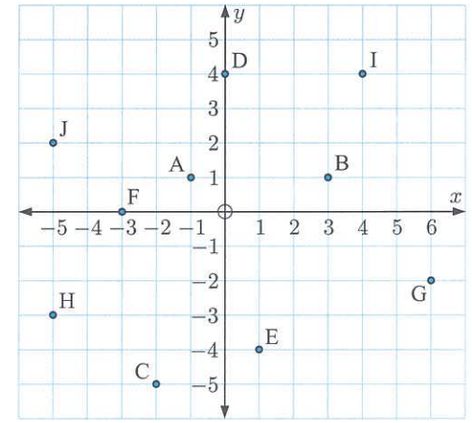
e E$(0, -1)$ **f** F$(4, 0)$ **g** G$(3, -4)$ **h** H$(0, 6)$

i I$(-5, -2)$ **j** J$(-4, -1)$ **k** K$(3, -3)$ **l** L$(-5, 4)$

2 On a set of axes, plot the points with coordinates given below. Join the points with straight line segments in the order given:

$(-3, 4)$, $(-1, 5)$, $(1, 5)$, $(3, 4)$, $(1, 3)$, $(-1, 3)$, $(-3, 4)$, $(-3, -2)$, $(-1, -3)$, $(1, -3)$, $(-3, 4)$, $(-1, 5)$, $(1, 5)$, $(3, 4)$, $(1, 3)$, $(-1, 3)$, $(-3, 4)$, $(-3, -2)$, $(-1, -3)$, $(1, -3)$, $(3, -2)$, $(3, 4)$, $(3, 3)$, $(4, 3)$, $(5, 2)$, $(5, 0)$, $(4, -1)$, $(3, -1)$, $(3, 0)$, $(4, 0)$, $(4, 2)$, $(3, 2)$

3 Consider the points on the set of axes shown.



a Write down the x-coordinate of:

i D **ii** B **iii** J **iv** G

b Write down the y-coordinate of:

i A **ii** C **iii** F **iv** I

c Write down the coordinates of all points.

d Which of the points lie:

i in the first quadrant

ii in the second quadrant

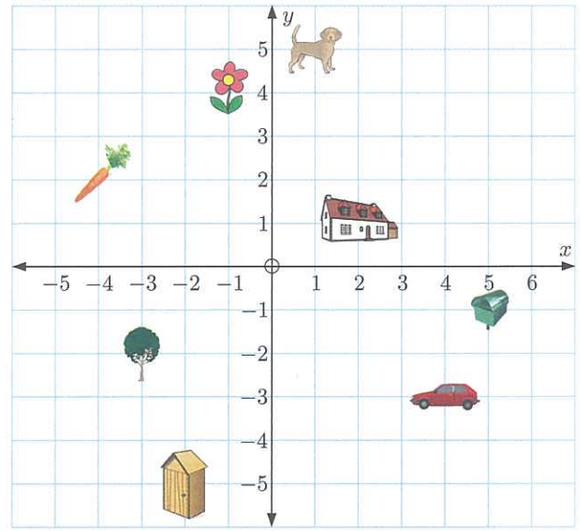
iii in the third quadrant

iv in the fourth quadrant

v on the x-axis

vi on the y-axis?

4 Consider the map alongside.



a Write down the coordinates of the:

i house

ii tree

iii flower garden

iv car

v dog

vi carrot patch

vii letterbox

viii toolshed

b Which of the things lie in the:

i first quadrant

ii second quadrant

iii third quadrant

iv fourth quadrant?

5 In which quadrant would you find a point where:

a both x and y are positive **b** both x and y are negative

c x is negative and y is positive **d** x is positive and y is negative?

6 Determine the quadrant in which the following points lie:

a A$(3, 5)$ **b** B$(2, -2)$ **c** C$(-1, -3)$ **d** D$(-4, 2)$

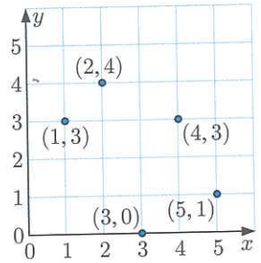
e E$(5, -3)$ **f** F$(4, -4)$ **g** G$(-2, -1)$ **h** H$(-3, 5)$

C PLOTTING POINTS FROM A TABLE OF VALUES

Tony plays lacrosse for his local club. The numbers of goals he has scored in the five games so far this season are shown below in a **table of values**:

Game number (x)	1	2	3	4	5
Goals scored (y)	3	4	0	3	1

We can display these values graphically by plotting the x and y-values on a number plane. The points $(1, 3)$, $(2, 4)$, $(3, 0)$, $(4, 3)$, and $(5, 1)$ are shown below.



EXERCISE 12C

1 Mike kept a record of the cars sold at his car yard each day last week:

Day number (x)	1	2	3	4	5	6	7
Cars sold (y)	3	1	2	0	4	7	5

Plot these points on a number plane.

2 While on ski camp, Ned recorded the minimum temperature reached each night. The results are given in the table below:

Night number (x)	1	2	3	4	5
Temperature ($y\,^\circ$C)	-2	0	-1	3	1

Plot these points on a number plane.

3 For each of the following tables of values, plot the points on a number plane:

a

x	1	2	3	4
y	2	4	1	2

b

x	0	1	2	3	4
y	3	-2	0	5	-1

c

x	-3	-1	0	2	3
y	4	2	-1	4	-2

d

x	-2	-1	0	1	2
y	3	0	2	-4	-3

4 **a** Plot the points for this table of values on a number plane.

x	-3	-1	0	2	3
y	0	2	3	5	6

b What do you notice about these points?

c Can you see a relationship between the x and y-coordinates of these points?

D GRAPHING STRAIGHT LINES

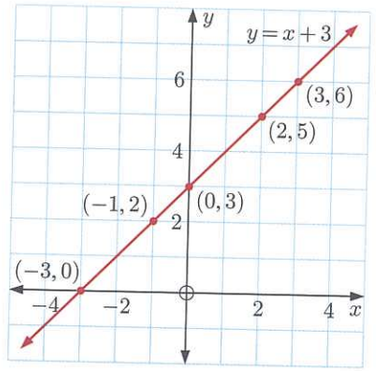
A **straight line** consists of an infinite number of points in a particular direction. We cannot list *all* of the points on a line in a table of values, but if we know *some* points on the line then we can plot them and hence draw the line through them.

THE EQUATION OF A LINE

The **equation of a line** is a rule which connects the x and y-coordinates of **all** points on the line.

In question **4** of the previous Exercise, you should have noticed that the plotted points lie in a straight line. For each of the points, the y-coordinate is 3 more than the x-coordinate.

The rule connecting the x and y-coordinates of each point on the line is $y = x + 3$. We say that $y = x + 3$ is the **equation** of the line.



Example 3 — Self Tutor

For each point on a line, the y-coordinate is 2 less than the x-coordinate. State the equation of the line.

The equation of the line is $y = x - 2$.

Suppose we know the equation of a line. If we are given the x-coordinate of any point on the line, we can use the equation to find the y-coordinate.

Example 4 — Self Tutor

The point P lies on the line with equation $y = x - 5$. The x-coordinate of P is 3. Find the y-coordinate of P.

Substituting $x = 3$ into $y = x - 5$ gives $y = 3 - 5$

$\therefore\ y = -2$

So, the y-coordinate of P is -2.

EXERCISE 12D.1

1 State the equation of a line if, for each point on the line:

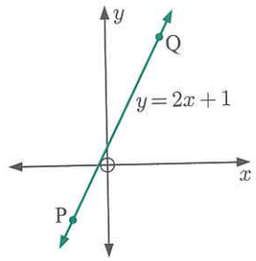
- **a** the y-coordinate is 5 more than the x-coordinate
- **b** the y-coordinate is 7 less than the x-coordinate
- **c** the y-coordinate is 3 times the x-coordinate
- **d** the y-coordinate is half the x-coordinate.

2 For each of the lines in **1**, state one point which lies on the line.

3 The point P lies on the line with equation $y = x + 6$. The x-coordinate of P is 4. Find the y-coordinate of P.

4 The point Q lies on the line with equation $y = 5x$. The x-coordinate of Q is -3. Find the y-coordinate of Q.

5 The graph of the line with equation $y = 2x + 1$ is shown alongside. P has x-coordinate -2, and Q has x-coordinate 3. Find the coordinates of P and Q.



GRAPHING STRAIGHT LINES

If we are given the equation of a line, we can graph the line using these steps:

Step 1: For each of the x-coordinates -2, -1, 0, 1, and 2, find the corresponding y-coordinate.

Hence complete a table of values like this:

x	-2	-1	0	1	2
y					

Step 2: Plot the points on a number plane.

Step 3: Draw a straight line through the points.

Step 4: Place arrows at the ends of the line to indicate that the line extends forever in both directions.

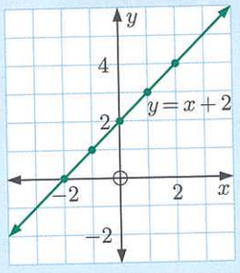
Example 5 **Self Tutor**

Draw the graph of the line with equation $y = x + 2$.

When $x = -2$, $y = -2 + 2 = 0$.
When $x = -1$, $y = -1 + 2 = 1$.
When $x = 0$, $y = 0 + 2 = 2$.
When $x = 1$, $y = 1 + 2 = 3$.
When $x = 2$, $y = 2 + 2 = 4$.

The table of values is:

x	-2	-1	0	1	2
y	0	1	2	3	4



EXERCISE 12D.2

1 Use a table of values to draw the graph of the line with equation:

- **a** $y = x$
- **b** $y = x + 4$
- **c** $y = x - 2$

2 Draw the graph of the line with equation:

- **a** $y = x + 1$
- **b** $y = x - 4$
- **c** $y = 2x$
- **d** $y = 1 - x$
- **e** $y = 2x + 1$
- **f** $y = 2x - 3$
- **g** $y = -3x$
- **h** $y = \frac{1}{2}x$
- **i** $y = 3 - 2x$

3 **a** Draw the graph of the line with equation $y = \frac{1}{2}x + 2$.

b Find the coordinates of the point where the graph cuts the: **i** y-axis **ii** x-axis.

DISCUSSION

Examine the graphs you have drawn, and the corresponding equations. What part of the equation do you think controls:

- the steepness of the line
- whether the graph slopes upwards or downwards
- where the graph cuts the y-axis?

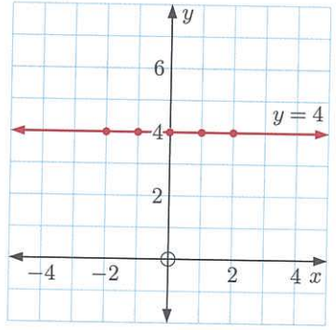
E HORIZONTAL AND VERTICAL LINES

Consider the line with equation $y = 4$.

At first it may be unclear how we should complete our table of values, because x is not mentioned in the equation. However, the equation means that no matter what the value of x is, the value of y is always 4.

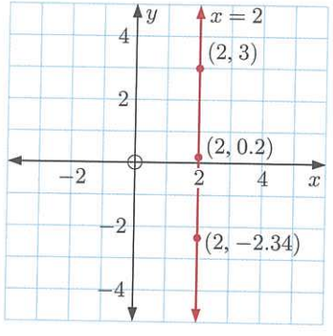
x	-2	-1	0	1	2
y	4	4	4	4	4

We can plot these points on a number plane. The result is a **horizontal line**. It includes all points with y-coordinate 4.



All **horizontal lines** have equations of the form $y = k$.

Similarly, the line with equation $x = 2$ consists of all points with x-coordinate 2. For example, (2, 3), (2, 0.2), and (2, -2.34) all lie on this line. The line is **vertical**.



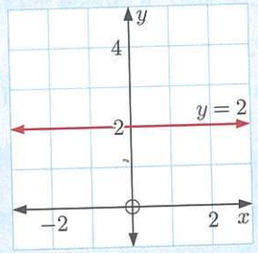
All **vertical lines** have equations of the form $x = k$.

Example 6 — Self Tutor

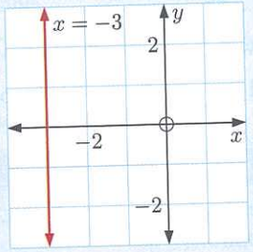
Draw the graph of:

a $y = 2$ **b** $x = -3$

a The line $y = 2$ consists of all points with y-coordinate 2.
It is a horizontal line.



b The line $x = -3$ consists of all points with x-coordinate -3.
It is a vertical line.



EXERCISE 12E

1 Draw the graph of:

a $y = 1$ **b** $x = 3$ **c** $y = -2$ **d** $x = -4$

e $x = 1.5$ **f** $y = -\frac{1}{2}$ **g** $x = 0$ **h** $y = 0$

2 **a** On the same set of axes, draw the graphs of $x = 4$ and $y = -3$.

b Write down the coordinates of the point where the lines meet.

KEY WORDS USED IN THIS CHAPTER

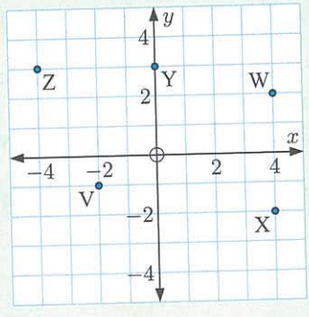
- axes
- equation
- ordered pair
- table of values
- y-axis
- Cartesian plane
- number grid
- origin
- x-axis
- y-coordinate
- coordinates
- number plane
- quadrant
- x-coordinate

REVIEW SET 12A

1 Write down the coordinates of point:

a V **b** W **c** X

d Y **e** Z



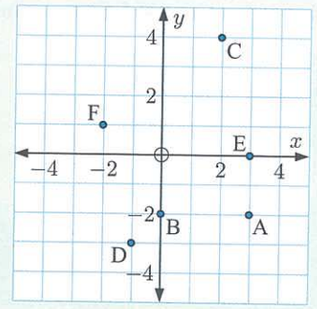
2 Plot and label the following points: F(4, −2), G(−5, −3), H(−1, 3), I(0, −4).

3 Write down:

a the x-coordinates of A and D

b the y-coordinates of B and C

c the coordinates of A, B, E, and F.



4 Determine the quadrant in which the following points lie:

a $(-2, 7)$ **b** $(-3, -6)$ **c** $(0, -2)$ **d** $(5, 1)$

5 The height of a plant is recorded on a weekly basis:

Week number (x)	1	2	3	4	5
Height (y cm)	6	9	11	13	14

Plot these points on a number plane.

6 **a** On a set of axes, plot and label the points A$(-3, 2)$, B$(-2, 3)$, and C$(-1, 4)$.

b If the pattern continues, what will the next point be?

7 For each table of values, plot the points on a number plane:

a

x	1	2	3	4	5
y	4	2	5	0	2

b

x	−2	−1	0	1	2
y	−7	−4	−1	2	5

8 State the equation of a line if, for each point on the line:

a the y-coordinate is 3 less than the x-coordinate

b the y-coordinate is twice the x-coordinate.

9 Using a table of values, graph the line with equation $y = 2x - 1$.

10 **a** Copy and complete the table of values for the line with equation $y = -5$:

x	−2	−1	0	1	2
y					

b Use your table of values to draw the graph of $y = -5$.

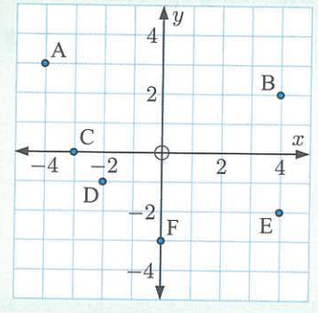
REVIEW SET 12B

1 Match each ordered pair with the correct point on the number plane:

a $(4, -2)$ **b** $(0, -3)$

c $(-4, 3)$ **d** $(4, 2)$

e $(-3, 0)$ **f** $(-2, -1)$



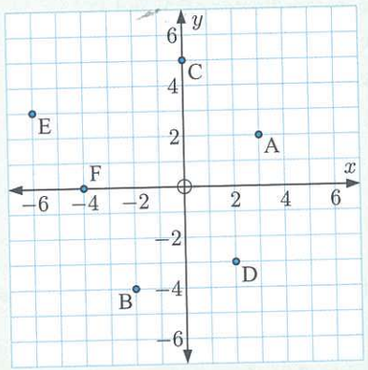
2 In which quadrant would I find a point with negative x and y-coordinates?

3 Write down:

a the x-coordinate of D

b the y-coordinate of E

c the coordinates of A and B.



4 On the same set of axes, plot and label the points A$(-3, 2)$, B$(1, 5)$, C$(-4, -2)$, and D$(0, -1)$.

5 Are $(3, 4)$ and $(4, 3)$ the same point on the number plane? Use an illustration in your answer.

6 The y-coordinate of each point on a line is two less than its x-coordinate.

a Write down the equation of this line.

b Find the coordinates of the point where this line crosses the y-axis.

7 Tina measured the rainfall at her house each day for 5 days. Her results are shown below:

Day number (x)	1	2	3	4	5
Rainfall (y mm)	5	2	9	0	4

Plot these points on a set of axes.

8 The point P lies on the line with equation $y = 3x - 2$. The x-coordinate of P is -2. Find the y-coordinate of P.

9 Draw the graph of the line with equation:

a $y = -\frac{1}{2}x$ **b** $y = 2x - 4$

10 Draw the graph of:

a $x = 1$ **b** $y = 3$ **c** $x = -2.5$ **d** $y = \frac{1}{4}$

Chapter 13

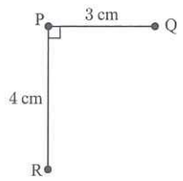
Further measurement

Contents:

4 **a** polygon **b** not a polygon as a side is not straight
c not a polygon as figure is not closed
d not a polygon as sides cross over

5 **a** $x = 60$ {exterior angle of triangle}
b $x = 40$ {angle sum of triangle}
c $x = 70$ {vertically opposite angles, angle sum of triangle}

6



7 **a** true **b** false

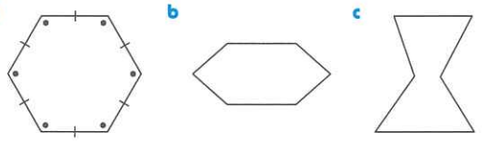
8 **a** right angled triangle {missing angle equals 90°, angle sum of triangle}
b parallelogram {opposite angles are equal}
c square {diagonals bisect each other at 90° and are equal in length}

9 **a** $a = 90$ **b** $b = 34$ **c** $c = 34$

10 **a** $x = 125$ {angle sum of quadrilateral}
b $x = 70$ {angles on a line}
$y = 65$ {angle sum of quadrilateral}
c $a = 80$ {angles on a line}
$b = 55$ {angles on a line}
$c = 120$ {angle sum of quadrilateral}

REVIEW SET 10B

1 **a** **b** **c**



2 **a** isosceles **b** scalene

3 **a** $x = 75$ {angle sum of triangle}
b $b = 58$ {angle sum of triangle}

4 **a** $x = 30$ {angles of isosceles triangle}
b $x = 140$ {exterior angle of triangle}

5 $a = 60$ {angles on a line}
$b = 30$ {angle sum of triangle}

6 parallelogram {diagonals bisect each other}

7 $a = 65$ {angles on a line}
$b = 70$ {angle sum of triangle}
$c = 45$ {vertically opposite angles, angle sum of triangle}

8 $x = 90$ {diagonals of a kite intersect at right angles}
$y = 64$ {angle sum of triangle}
$z = 30$ {equal opposite angles of kite}

9 **a** parallelogram
b $x = 88$ {opposite angles of a parallelogram}
$y = 92$ {co-interior angles supplementary}

10 The sum of four acute angles is less than 360°.

EXERCISE 11A

1 **a** km **b** mm **c** m **d** cm **e** m **f** mm

2 **a** **B** **b** **C** **c** **C**

3 **a** 25 mm **b** 26 mm **c** 8 mm **d** 59 mm
e 5 mm **f** 18 mm

4 **a** 400 cm **b** 2 cm **c** 290 cm **d** 300 000 cm

5 **a** 8 m **b** 7000 m **c** 120 000 m **d** 32 m

6 **a** 90 mm **b** 3000 mm **c** 1200 mm **d** 450 000 mm

7 **a** 15 km **b** 7.5 km **c** 0.6 km **d** 2.5 km

8 **a** 60 mm **b** 7 m **c** 3 km **d** 8 cm
e 1100 cm **f** 4000 m **g** 32 mm **h** 2.4 m
i 3.8 km **j** 1.7 cm **k** 780 cm **l** 600 m

9 **a** 459.5 cm **b** 512.7 cm **c** 3432.2 m **d** 8926.5 m

10 40 000 pipes **11** 19.6 cm **12** 200 lengths **13** 10.8 km

EXERCISE 11B

1 **a** 10 units **b** 14 units **c** 18 units **d** 12 units
e 16 units **f** 26 units

2 **a** 112 mm **b** 125 mm **c** 89 mm

3 **a** 15 cm **b** 14 cm **c** 16 cm **d** 36 cm
e 56 m **f** 24.6 m

4 **a** 16 m **b** 44 cm **c** 12 m **d** 15 m
e 6.4 cm **f** 11.6 m

5 **a** 29 mm or 2.9 cm **b** 114 mm or 11.4 cm
c 1020 cm or 10.2 m **d** 4.4 m **e** 11.8 km
f 5.2 km

6 **a** 480 cm **b** 544 cm **7** \$13 770 **8** 540 cm

9 34.58 km **10** **a** **i** 26 cm **ii** 35 cm **b** 8.2 m

EXERCISE 11C.1

1 **a** 20 units^2 **b** 6 units^2 **c** 33 units^2 **d** 35 units^2

2 **a** m^2 **b** cm^2 **c** km^2 **d** mm^2 **e** ha

EXERCISE 11C.2

1 **a** 500 mm^2 **b** 25 cm^2 **c** 70 000 m^2
d 36 000 cm^2 **e** 40 ha **f** 8300 mm^2
g 800 000 m^2 **h** 1.56 m^2 **i** 12 km^2
j 9 cm^2 **k** 7.6 ha **l** 280 mm^2
m 25 ha **n** 124 800 cm^2 **o** 9200 mm^2

2 15 000 mm^2 **3** **a** Bruno **b** Carlos

4 **a** 57 000 m^2 **b** 3420 kg **c** €2719.45

EXERCISE 11D.1

1 **a** 40 cm^2 **b** 36 cm^2 **c** 225 m^2 **d** 220 m^2

2 **b** 21 cm $\times$ 29.7 cm $\approx$ 624 cm^2

3 **a** 2400 m^2 **b** 80 minutes

4 **a** 720 pavers **b** £3960

5 **a** 1440 ha **b** \$1 728 000

6 6 cm **7** 12 m **8** 4.8 m

EXERCISE 11D.2

1 **a** 18 cm^2 **b** 66 m^2 **c** 24 m^2 **d** 35 cm^2
e 54 m^2 **f** 7.5 cm^2 **g** 13 m^2 **h** 45 cm^2

2 36 m^2 **3** 42 m^2 **4** 6 cm

EXERCISE 11D.3

1 **a** 48 m^2 **b** 66 cm^2 **c** 80 cm^2 **d** 20 cm^2
e 24 cm^2 **f** 84 m^2

2 **a** 16 cm^2 **b** 63 m^2 **c** 25 cm^2 **d** 42 cm^2
e 13 m^2 **f** 42 cm^2

3 600 cm^2 **4** 22.62 cm^2

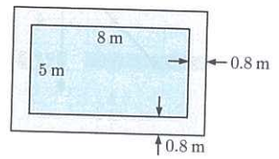
5 **a** 7040 cm^2 **b** £11.26 **6** 5 cm

EXERCISE 11E

1 **a** 90 cm^2 **b** 34 m^2 **c** 33 m^2 **d** 30 km^2
e 24 cm^2 **f** 50 m^2

2 **a** 41 cm^2 **b** 45 m^2

3 **a**



b 23.36 m^2
c \$747.52

4 **a** 400 cm^2 **b** 128 cm^2 **c** 144 cm^2

5 **a** 5600 cm^2 **b** 7200 cm^2 **c** 900 cm^2
d 76 300 cm^2 or 7.63 m^2

6 **a** 4 cm^2 **b** 0.5 cm^2 **c** 2 cm^2 **d** $\sqrt{2}$ cm

REVIEW SET 11A

1 **a** m^2 **b** km^2 **c** cm^2

2 **a** 129 mm **b** 3950 m **c** 243 cm
d 0.1459 m^2 **e** 94 000 m^2 **f** 1280 mm^2

3 **a** 28 m **b** 38 cm **c** 310 cm or 3.1 m

4 **a** 5.29 m^2 **b** 60 m^2 **c** 85.5 cm^2

5 2511.9 m **6** **a** 184 ha **b** 3680 trees

7 800 triangles **8** **a** 80 m^2 **b** 28 cm^2

9 **a** 72 m **b** 36 m^2 **c** 13 m^2

10 **a** **i** 350 cm^2 **ii** 175 cm^2
b 19 $\times$ 350 cm^2 + 2 $\times$ 175 cm^2 = 350 cm $\times$ 20 cm ✓

REVIEW SET 11B

1 **a** m **b** cm **2** **a** 4.9 cm **b** 2.99 cm^2 **c** 684 ha

3 **a** 30 m **b** 21 cm **c** 44 cm

4 **a** 30 m^2 **b** 30 cm^2 **5** 14.6 m **6** \$570

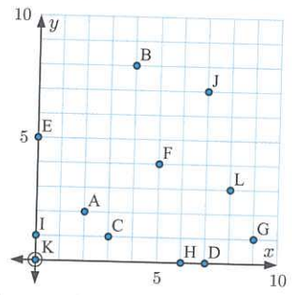
7 43.73 m^2 **8** **a** 128 cm^2 **b** 8 m^2

9 **a** 1500 cm^2 **b** **i** 495 cm^2 **ii** 66.9 cm^2
c 376.2 cm^2

10 **a** 6 km **b** 300 km **c** 1.2 km^2

EXERCISE 12A

1



2 **a** The y-coordinate of a point on the x-axis is 0.
b The x-coordinate of a point on the y-axis is 0.

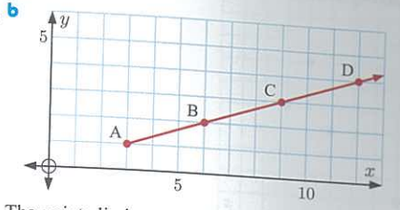
3 **a** **i** 6 **ii** 2 **iii** 9 **iv** 6
b **i** 2 **ii** 1 **iii** 5 **iv** 6
c A(2, 8), B(6, 4), C(9, 9), D(2, 3), E(8, 2), F(5, 7), G(6, 6), H(4, 1), I(9, 5), J(2, 5), K(0, 6)
d O(0, 0)

4 **a** C and G. They lie on the same vertical line.
b E and F. They lie on the same horizontal line. **c** E(7, 7)

5 D(2, 3)

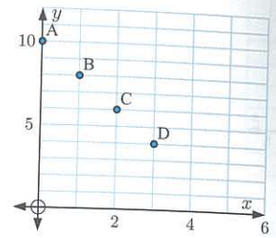
6 **a** **i** (7, 5) **ii** (9, 2) **iii** (7, 7) **iv** (2, 1) and (6, 6)
b **i** Treasure Trove **ii** Lion's Den **iii** Mt. Ogre
iv Oasis

7 **a, b**



The points lie in a straight line.
c E(15, 5)

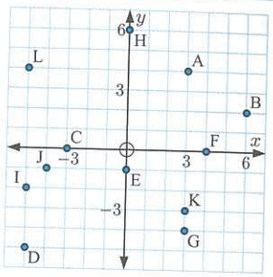
8 **a**



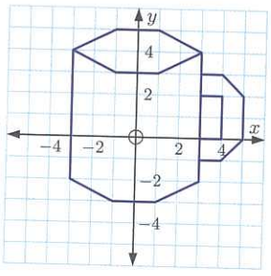
b E(4, 2) and F(5, 0)

EXERCISE 12B

1



2



3 **a** **i** 0 **ii** 3 **iii** −5 **iv** 6
b **i** 1 **ii** −5 **iii** 0 **iv** 4
c A(−1, 1), B(3, 1), C(−2, −5), D(0, 4), E(1, −4), F(−3, 0), G(6, −2), H(−5, −3), I(4, 4), J(−5, 2)
d **i** B, I **ii** A, J **iii** C, H **iv** E, G **v** F **vi** D

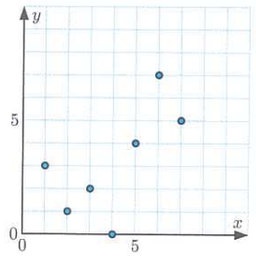
4 **a** **i** (2, 1) **ii** (−3, −2) **iii** (−1, 4) **iv** (4, −3)
v (1, 5) **vi** (−4, 2) **vii** (5, −1) **viii** (−2, −5)
b **i** dog, house **ii** flower garden, carrot patch
iii tree, toolshed **iv** car, letterbox

5 **a** first quadrant **b** third quadrant
c second quadrant **d** fourth quadrant

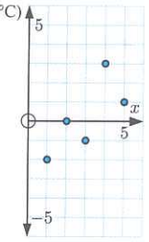
6 **a** first **b** fourth **c** third **d** second
e fourth **f** fourth **g** third **h** second

EXERCISE 12C

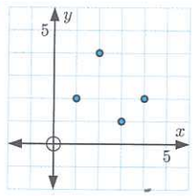
1



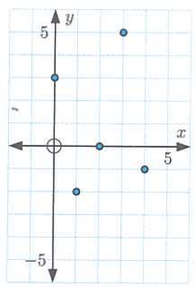
2



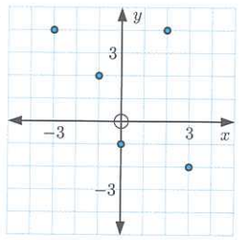
3 **a**



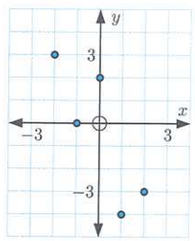
b



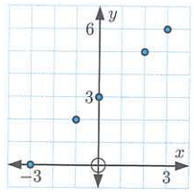
c



d



4 **a**



b The points lie in a straight line.

c Yes, each y-value is 3 more than its corresponding x-value.

EXERCISE 12D.1

1 **a** $y = x + 5$ **b** $y = x - 7$ **c** $y = 3x$ **d** $y = \frac{1}{2}x$

2 **Note:** Other answers are possible.
a (1, 6) **b** (10, 3) **c** (1, 3) **d** (2, 1)

3 10 **4** -15 **5** P$(-2, -3)$, Q$(3, 7)$

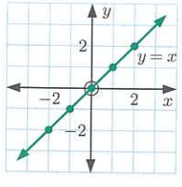
EXERCISE 12D.2

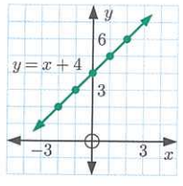
1 **a**

x	−2	−1	0	1	2
y	−2	−1	0	1	2

b

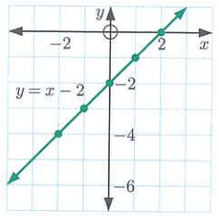
x	−2	−1	0	1	2
y	2	3	4	5	6



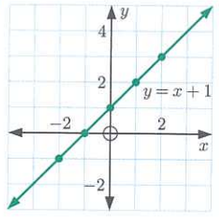


c

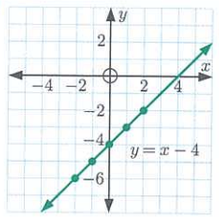
x	−2	−1	0	1	2
y	−4	−3	−2	−1	0



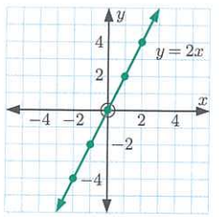
2 **a**



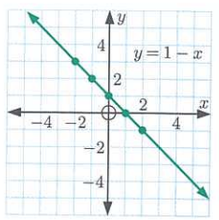
b



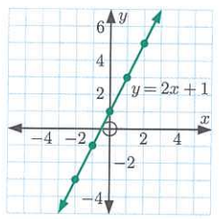
c



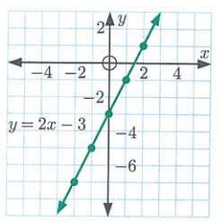
d



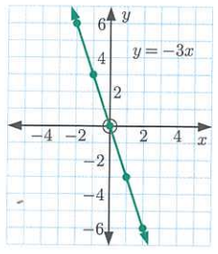
e



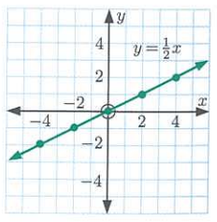
f



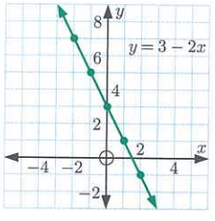
g



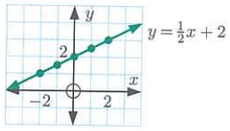
h



i



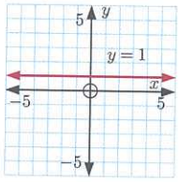
3 **a**



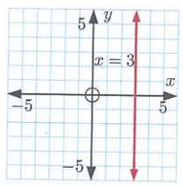
b **i** (0, 2)
ii $(-4, 0)$

EXERCISE 12E

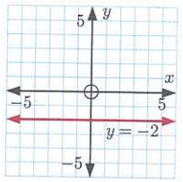
1 **a**



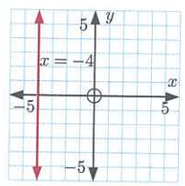
b



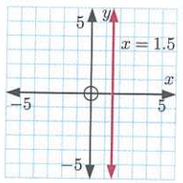
c



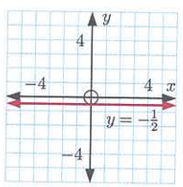
d



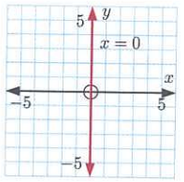
e



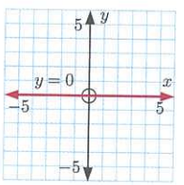
f



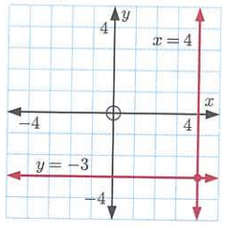
g



h



2 **a**

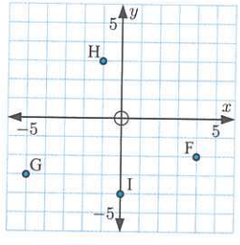


b $(4, -3)$

REVIEW SET 12A

1 **a** V$(-2, -1)$ **b** W$(4, 2)$ **c** X$(4, -2)$
d Y$(0, 3)$ **e** Z$(-4, 3)$

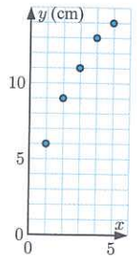
2



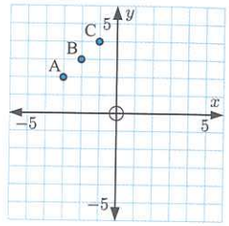
3 **a** x-coordinate of A is 3, x-coordinate of D is -1
b y-coordinate of B is -2, y-coordinate of C is 4
c A$(3, -2)$, B$(0, -2)$, E$(3, 0)$, F$(-2, 1)$

4 **a** second **b** third **c** on the negative y-axis **d** first

5

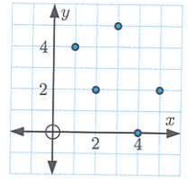


6 **a**

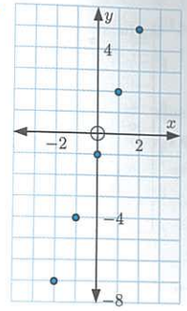


b D$(0, 5)$

7 **a**



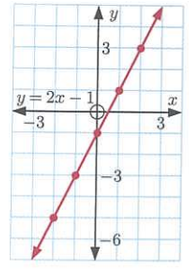
b



8 **a** $y = x - 3$ **b** $y = 2x$

9

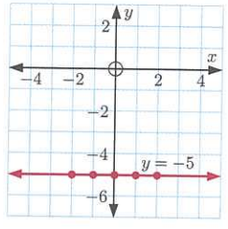
x	−2	−1	0	1	2
y	−5	−3	−1	1	3



10 **a**

x	−2	−1	0	1	2
y	−5	−5	−5	−5	−5

b

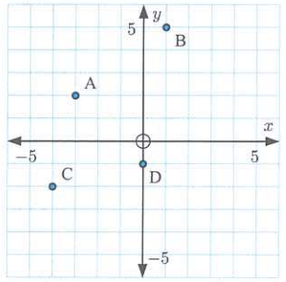


REVIEW SET 12B

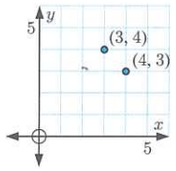
1 **a** E **b** F **c** A **d** B **e** C **f** D

2 third **3** **a** 2 **b** 3 **c** A(3, 2), B(−2, −4)

4

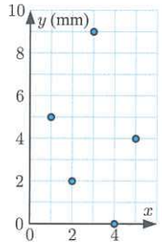


5 No, they are different points.



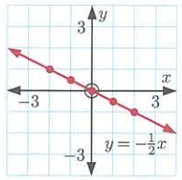
6 **a** $y = x - 2$ **b** (0, −2)

7

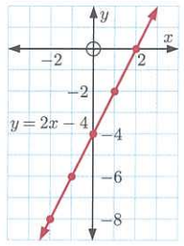


8 −8

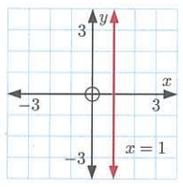
9 **a**



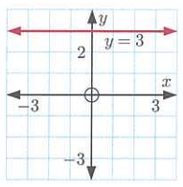
b



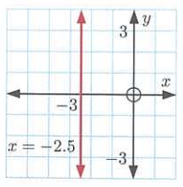
10 **a**



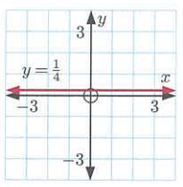
b



c



d



EXERCISE 13A.1

1 **a** 16 units^3 **b** 54 units^3 **c** 36 units^3

2 **a** **b** has the greatest volume. **b** **a** has the least volume.

3 **a** cm^3 **b** cm^3 **c** m^3 **d** mm^3 **e** cm^3
f cm^3 **g** m^3 **h** cm^3 **i** mm^3

EXERCISE 13A.2

1 **a** 48 000 mm^3 **b** 0.029 m^3 **c** 1 200 000 cm^3
d 12.485 cm^3 **e** 450 cm^3 **f** 0.0145 m^3
g 295 mm^3 **h** 0.001 43 cm^3 **i** 5 600 000 mm^3

2 1.5 m^3 **3** 235 000 cm^3 **4** 200 000 pieces

EXERCISE 13B.1

1 **a** 16 units^3 **b** 45 units^3 **c** 36 units^3

2 **a** 720 mm^3 **b** 125 cm^3 **c** 81 m^3

3 **a** 29 600 mm^3 **b** 20.832 m^3

4 **B**, by 16 cm^3 **5** 12 m^3 **6** 1.44 m^3 **7** 4 cm

EXERCISE 13B.2

1 **a** 112 m^3 **b** 780 cm^3 **c** 44 cm^3 **d** 192 mm^3
e 119 m^3 **f** 6.4 cm^3

2 168 m^3 **3** 8 cm

4 **a** 36 m^3 **b** 42 cm^3 **c** 180 cm^3 **d** 135 m^3
e 144 m^3 **f** 480 000 cm^3

5 32.5 cm^3 **6** \$271.44

7 **a** 4800 cm^3 **b** 2400 cm^3 **c** $\frac{1}{2}$

EXERCISE 13C

1 **C** **2** **D** **3** **A** **4** **C**

5 **a** 8 L **b** 2000 kL **c** 0.786 kL **d** 0.04 L
e 3950 L **f** 1 000 000 000 mL

6 64 bottles **7** 4.96 kL

EXERCISE 13D

1 **a** 7500 cm^3 **b** 7500 mL **c** 7.5 L

2 12 kL **3** 2.4 L **4** 72 L

5 **a** 1125 cm^2 **b** 337 500 cm^3
c **i** 337.5 L **ii** 0.3375 kL

6 5 cm

EXERCISE 13E

1 **a** g **b** kg **c** g **d** mg **e** t **f** kg

2 **a** 3000 g **b** 6.79 g **c** 0.029 g **d** 540 g
e 1 200 000 g **f** 5.249 g **g** 10 370 g **h** 250 000 g

3 **a** 6000 kg **b** 4 kg **c** 0.35 kg
d 0.4 kg **e** 2400 kg **f** 0.285 kg
g 0.001 436 kg **h** 0.000 05 kg

4 504 g **5** 2000 lollipops **6** 4000 bricks **7** 1200 kg

8 19 kg **9** **a** 80 g **b** 0.997 92 m^2 $\approx$ 1 m^2 **c** $\approx$ 5.00 g

EXERCISE 13F

1 6 g **2** 4 kg **3** 3.45 kg

4 **a** 9.6 L **b** 9.6 kg **c** 8.4 kg

EXERCISE 13G

1 **a** 1020 min **b** 23 min **c** 4320 min
d 268 min **e** 7893 min

2 **a** 3287$\frac{1}{4}$ days **b** 6 days **c** 48 days **d** 3 days

3 **a** 21 600 s **b** 780 s **c** 44 160 s **d** 4 838 400 s

4 1 h 20 min **5** 134 min **6** $\approx$ 57 days **7** 2 h 7 min

EXERCISE 13H

1 **a** 4 h 25 min **b** 7 h 16 min **c** 2 h 48 min
d 3 h 46 min **e** 9 h 3 min **f** 1 day 2 h 20 min

2 1 h 42 min **3** 2 h 23 min

4 **a** 8 h 55 min **b** 52 min

5 **a** 37 min **b** 33 min **c** 24 min

6 **a** Deborah **b** Terry
c 1 h 15 min, from 2:15 until 3:30 **d** no **e** £337.50

7 **a** 8:12 pm **b** 4:09 pm **c** 12:30 pm **d** 5:10 pm
e 8:05 am **f** 4:30 am the next day

8 1:45 pm **9** 4:45 pm

10 **a** Otter Odyssey **g** **i** 2 h 55 min
b 3D Underwater World **ii**

Show	*Time*
Diving Dolphins	1:40
Whale Mania	3:15
Seal of Approval	11:30
Otter Odyssey	10:00
3D Underwater World	12:30
Marine Park Parade	4:00

c 2:05 pm
d Whale Mania, and 3D Underwater World
e 9:45 am
f 2 h 25 min

EXERCISE 13I

1 **a** 7 am **b** 2 pm **c** 8 pm **d** 8 pm

2 **a** 11 am Wednesday **b** 3 am Wednesday
c 8 am Wednesday **d** 7 pm Tuesday

3 **a** 11 pm Thursday **b** 8 am Friday
c 10 am Friday **d** 3 pm Friday

4 5 pm **5** **a** 3 pm **b** 8 pm **c** 4 am the next day

6 10:45 pm **7** 8 am the next day **8** 8 hours

REVIEW SET 13A

1 **a** 5.86 L **b** 6300 min **c** 0.046 kL
d 2500 kg **e** 2 360 000 cm^3 **f** 7.02 L

2 **a** 36 units^3 **b** 93.6 cm^3 **c** 108 cm^3

3 €4438.72 **4** 4500 kg

5 **a** 0.4125 kL **b** 412.5 kg **6** 30 river crossings

7 **a** 1:20 pm **b** 3:46 pm **c** 4:37 pm **d** 8:15 am

8 15.3 cm^3

9 **a** 1 L **b** 1 h 40 min **c** after 4:10 pm

10 **a** 11 am **b** 2 am

REVIEW SET 13B

1 **a** 463 min **b** 32.7 cm^3 **c** 5.7 g
d 3900 mL **e** 50 days **f** 1 200 000 cm^3

2 100 000 dominoes **3** 17 h 4 min

4 **a** 435.6 cm^3 **b** 4368 cm^3 **5** 16.25 L

6 480 L **7** 8:21 am **8** **a** 7 kg **b** 7.95 kg

9 6:30 am

10 **a** **i** 10 hours **ii** $7\frac{1}{2}$ hours **b** Thursday
c 65 hours

EXERCISE 14A

1 **a** 4 : 5 **b** 15 : 8 **c** 1 : 4 **d** 8 : 7
e 9 : 5 **f** 2 : 11

2 **a** 3 : 4 **b** 1 : 7 **c** 2 : 3 **d** 3 : 5

3 **a** 17 : 100 **b** 50 : 60 **c** 1000 : 150
d 9 : 24 **e** 12 : 180 **f** 400 : 1000

4 **a** 152 : 164 **b** 2 : 5 **c** 3 : 500 **d** 20 : 12

5 **a** 8 : 5 **b** 200 : 800 **c** 2000 : 700 **d** 350 : 1000

EXERCISE 14B

1 **a** $\frac{3}{8}$ **b** $\frac{5}{8}$ **2** **a** $\frac{2}{5}$ **b** $\frac{3}{5}$

3 **a** **i** 1 : 3 **ii** $\frac{1}{4}$ **iii** 25%
b **i** 2 : 3 **ii** $\frac{2}{5}$ **iii** 40%
c **i** 3 : 7 **ii** $\frac{3}{10}$ **iii** 30%
d **i** 2 : 1 **ii** $\frac{2}{3}$ **iii** $66\frac{2}{3}\% \approx 66.7\%$
e **i** 3 : 1 **ii** $\frac{3}{4}$ **iii** 75%
f **i** 6 : 2 **ii** $\frac{3}{4}$ (or $\frac{6}{8}$) **iii** 75%

EXERCISE 14C

1 **a** 12 : 30 **b** 2 : 5

2 **a** 1 : 3 **b** 3 : 1 **c** 1 : 5 **d** 3 : 1 **e** 4 : 5
f 7 : 4 **g** 2 : 5 **h** 3 : 2 **i** 2 : 3 **j** 2 : 7

3 **a** 1 : 1 **b** 3 : 2 **c** 3 : 1 **d** 1 : 2 **e** 16 : 3
f 5 : 4

4 **a** 1 : 3 **b** 1 : 2 **c** 1 : 2 **d** 1 : 1 **e** 3 : 5
f 2 : 1

5 **a** 1 : 10 **b** 3 : 10 **c** 1 : 2 **d** 1 : 5 **e** 1 : 4
f 1 : 10 **g** 3 : 2 **h** 1 : 20 **i** 4 : 1 **j** 5 : 7
k 5 : 1 **l** 3 : 5 **m** 2 : 5 **n** 1 : 15 **o** 1 : 120
p 7 : 8

6 **a** equal **b** equal **c** not equal **d** equal
e not equal **f** not equal **g** equal **h** not equal

7 **a** $\square = 6$ **b** $\square = 3$ **c** $\square = 33$ **d** $\square = 15$
e $\square = 18$ **f** $\square = 8$ **g** $\square = 4$ **h** $\square = 2$
i $\square = 1$ **j** $\square = 10$ **k** $\square = 28$ **l** $\square = 20$

EXERCISE 14D

1 **a** 36 doctors **b** 150 nurses **2** 20 teachers

3 21 CDs **4** 56 station wagons

5 **a** 1 : 10 **b** 10 mL of chocolate topping

6 120 g (45 g raisins and 75 g nuts)

EXERCISE 14E

1 **a** **i** $\frac{2}{3}$ **ii** $\frac{1}{3}$
b **i** 12 chocolates **ii** 6 chocolates

2 **a** 125 g beetroot, 75 g yoghurt
b 375 g beetroot, 225 g yoghurt

3 **a** 160 mL pineapple, 240 mL orange
b 400 mL pineapple, 600 mL orange

4 **a** £5, £25 **b** \$20, \$8 **5** €480 **6** ¥48 000

EXERCISE 14F.1

1 **a** 1 : 100, scale factor is 100
b 1 : 100 000, scale factor is 100 000
c 1 : 3000, scale factor is 3000
d 1 : 2 000 000, scale factor is 2 000 000
e 1 : 250 000, scale factor is 250 000
f 1 : 20 000 000, scale factor is 20 000 000

2 **a** 1 cm represents 2.5 m **b** 1 cm represents 40 m
c 1 cm represents 5 m **d** 1 cm represents 250 m
e 1 cm represents 1.5 km **f** 1 cm represents 220 km

3 **a** 1 : 6000 **b** 1 : 1000